

CLAIMS

What is claimed is:

1 1. A method for processing an input signal for application to an amplifier to generate an amplified
2 output signal, comprising:
3 generating an index into a look-up table based on the input signal;
4 adjusting the index to compensate for changes in operating characteristics of the amplifier over time;
5 retrieving one or more pre-distortion parameters from the look-up table based on the adjusted index;
6 and
7 pre-distorting the input signal based on the one or more pre-distortion parameters to generate a pre-
8 distorted input signal for application to the amplifier.

1 2. The invention of claim 1, wherein the index is adjusted based on a measure of distortion in the
2 amplified output signal.

1 3. The invention of claim 2, wherein the measure of distortion is based on a narrow-band power
2 level in the amplified output signal.

1 4. The invention of claim 1, further comprising amplifying the pre-distorted input signal with the
2 amplifier to generate the amplified output signal.

1 5. The invention of claim 4, wherein amplifying the pre-distorted input signal comprises controlling
2 overall gain of the amplifier to compensate for the changes in the operating characteristics of the
3 amplifier.

1 6. The invention of claim 5, wherein the overall gain is controlled based on a comparison of power
2 of the pre-distorted input signal and power of the amplified output signal.

1 7. The invention of claim 5, wherein the overall gain is controlled to keep the overall gain
2 substantially constant over time.

1 8. The invention of claim 7, wherein the overall gain is further controlled to reduce distortion in the
2 amplified output signal.

1 9. The invention of claim 5, wherein the overall gain is controlled to reduce distortion in the
2 amplified output signal.

1 10. The invention of claim 5, wherein amplifying the pre-distorted input signal further comprises
2 controlling bias applied to one or more amplifier stages of the amplifier.

1 11. The invention of claim 10, wherein the bias is controlled based on a measure of distortion in the
2 amplified output signal.

1 12. The invention of claim 11, wherein the measure of distortion is based on a narrow-band power
2 level in the amplified output signal.

1 13. The invention of claim 4, wherein amplifying the pre-distorted input signal comprises controlling
2 bias applied to one or more amplifier stages of the amplifier.

1 14. The invention of claim 13, wherein the bias is controlled based on a measure of distortion in the
2 amplified output signal.

1 15. The invention of claim 14, wherein the measure of distortion is based on a narrow-band power
2 level in the amplified output signal.

1 16. The invention of claim 1, wherein the look-up table corresponds to frequency-independent pre-
2 distortion processing.

1 17. The invention of claim 1, wherein the look-up table corresponds to frequency-dependent pre-
2 distortion processing.

1 18. The invention of claim 1, further comprising:
2 retrieving one or more other pre-distortion parameters from a different look-up table based on the
3 input signal; and
4 pre-distorting the input signal based on the one or more other pre-distortion parameters to generate a
5 different pre-distortion component for the pre-distorted input signal, wherein the different look-up table
6 is automatically updated by:
7 generating a measure based on current operations of the amplifier;

8 applying the measure to one or more algebraic equations to generate one or more parameter
9 values; and
10 applying the one or more parameter values to one or more polynomials to update the different
11 look-up table.

1 19. The invention of claim 1, wherein the look-up table is automatically updated by:
2 generating a measure based on current operations of the amplifier;
3 applying the measure to one or more algebraic equations to generate one or more parameter values;
4 and
5 applying the one or more parameter values to one or more polynomials to update the look-up table.

1 20. The invention of claim 1, wherein the look-up table is generated during training of the amplifier
2 and always kept fixed after training is complete.

1 21. The invention of claim 1, wherein the index is based on power of the input signal.

1 22. Apparatus for processing an input signal for application to an amplifier to generate an amplified
2 output signal, comprising:
3 an index generator adapted to generate an index into a look-up table based on the input signal;
4 an index adjuster adapted to adjust the index to compensate for changes in operating characteristics
5 of the amplifier over time;
6 the look-up table adapted to provide one or more pre-distortion parameters based on the adjusted
7 index; and
8 a pre-distorter adapted to pre-distort the input signal based on the one or more pre-distortion
9 parameters to generate a pre-distorted input signal for application to the amplifier.

1 23. The invention of claim 22, wherein the index adjuster is adapted to adjust the index based on a
2 measure of distortion in the amplified output signal.

1 24. The invention of claim 23, wherein the measure of distortion is based on a narrow-band power
2 level in the amplified output signal.

1 25. The invention of claim 22, further comprising the amplifier adapted to amplify the pre-distorted
2 input signal to generate the amplified output signal.

1 26. The invention of claim 25, wherein the amplifier is adapted to control overall gain of the
2 amplifier to compensate for the changes in the operating characteristics of the amplifier.

1 27. The invention of claim 26, wherein the amplifier is adapted to control the overall gain based on a
2 comparison of power of the pre-distorted input signal and power of the amplified output signal.

1 28. The invention of claim 26, wherein the amplifier is adapted to control the overall gain to keep the
2 overall gain substantially constant over time.

1 29. The invention of claim 28, wherein the overall gain is further controlled to reduce distortion in
2 the amplified output signal.

1 30. The invention of claim 26, wherein the overall gain is controlled to reduce distortion in the
2 amplified output signal.

1 31. The invention of claim 26, wherein the amplifier is further adapted to control bias applied to one
2 or more amplifier stages of the amplifier.

1 32. The invention of claim 31, wherein the amplifier is adapted to control the bias based on a
2 measure of distortion in the amplified output signal.

1 33. The invention of claim 32, wherein the measure of distortion is based on a narrow-band power
2 level in the amplified output signal.

1 34. The invention of claim 25, wherein the amplifier is adapted to control bias applied to one or more
2 amplifier stages of the amplifier.

1 35. The invention of claim 34, wherein the amplifier is adapted to control the bias based on a
2 measure of distortion in the amplified output signal.

1 36. The invention of claim 35, wherein the measure of distortion is based on a narrow-band power
2 level in the amplified output signal.

1 37. The invention of claim 25, further comprising:
2 a first power detector adapted to detect power of the pre-distorted input signal;
3 a second power detector adapted to detect power of the amplified output signal;
4 a receiver adapted to detect narrow-band power of the amplified output signal at a selected
5 frequency; and
6 a controller adapted to process the detected powers from the first and second power detectors and
7 from the receiver to generate one or more control signals used to control operations within the apparatus.

1 38. The invention of claim 37, wherein the one or more control signals control the index adjuster, a
2 variable attenuator in the amplifier, and bias levels applied to one or more amplifier stages in the
3 amplifier.

1 39. The invention of claim 37, wherein the first and second power detectors are wide-band power
2 detectors.

1 40. The invention of claim 37, wherein the controller is adapted to change the selection of the
2 frequency of the receiver.

1 41. The invention of claim 22, wherein the look-up table corresponds to frequency-independent pre-
2 distortion processing.

1 42. The invention of claim 22, wherein the look-up table corresponds to frequency-dependent pre-
2 distortion processing.

1 43. The invention of claim 22, further comprising:
2 a different look-up table adapted to provide one or more other pre-distortion parameters based on the
3 input signal, wherein the pre-distorter is further adapted to pre-distort the input signal based on the one or
4 more other pre-distortion parameters to generate a different pre-distortion component for the pre-
5 distorted input signal; and
6 a controller adapted to automatically update the different look-up table by:
7 generating a measure based on current operations of the amplifier;
8 applying the measure to one or more algebraic equations to generate one or more parameter
9 values; and

10 applying the one or more parameter values to one or more polynomials to update the different
11 look-up table.

1 44. The invention of claim 22, further comprising a controller adapted to automatically update the
2 look-up table by:
3 generating a measure based on current operations of the amplifier;
4 applying the measure to one or more algebraic equations to generate one or more parameter values;
5 and
6 applying the one or more parameter values to one or more polynomials to update the look-up table.

1 45. The invention of claim 22, wherein the look-up table is generated during training of the amplifier
2 and always kept fixed after training is complete.

1 46. The invention of claim 22, wherein the index is based on power of the input signal.

1 47. A method for processing an input signal for application to an amplifier to generate an amplified
2 output signal, comprising:
3 retrieving one or more pre-distortion parameters from a look-up table based on the input signal; and
4 pre-distorting the input signal based on the one or more pre-distortion parameters to generate a pre-
5 distorted input signal for application to the amplifier, wherein the look-up table is automatically updated
6 by:
7 generating a measure based on current operations of the amplifier;
8 applying the measure to one or more algebraic equations to generate one or more parameter
9 values; and
10 applying the one or more parameter values to one or more polynomials to update the look-up
11 table.

1 48. The invention of claim 47, wherein the measure is average power of the input signal.

1 49. The invention of claim 47, wherein each algebraic equation is a piecewise linear curve.

1 50. The invention of claim 47, wherein:
2 the measure is applied to four algebraic equations to generate four parameter values; and

3 the four parameter values are applied to two second-order polynomials to update two pre-distortion
4 parameters in the look-up table.

1 51. The invention of claim 47, wherein the pre-distortion parameters are frequency-dependent pre-
2 distortion parameters.

1 52. The invention of claim 47, wherein the pre-distortion parameters are frequency-independent pre-
2 distortion parameters.

1 53. The invention of claim 47, wherein the look-up table is updated at a specified periodic rate.

1 54. The invention of claim 47, wherein the look-up table is updated based on a detected change in
2 operating conditions of the amplifier.

1 55. The invention of claim 54, wherein the detected change in the amplifier operating conditions
2 corresponds to a change in a parameter value greater than a specified threshold value.

1 56. The invention of claim 47, wherein the one or more parameter values are fine-tuned based on
2 output spectrum of the amplifier.

1 57. Apparatus for processing an input signal for application to an amplifier to generate an amplified
2 output signal, comprising:

3 a look-up table adapted to provide one or more pre-distortion parameters based on the input signal;

4 a pre-distorter adapted to pre-distort the input signal based on the one or more pre-distortion
5 parameters to generate a pre-distorted input signal for application to the amplifier; and

6 a controller adapted to automatically update the look-up table by:

7 generating a measure based on current operations of the amplifier;

8 applying the measure to one or more algebraic equations to generate one or more parameter
9 values; and

10 applying the one or more parameter values to one or more polynomials to update the look-up
11 table.

1 58. The invention of claim 57, wherein:

2 the measure is average power of the input signal; and

3 further comprising an envelope detector adapted to detect current power of the input signal, wherein
4 the controller uses the current input signal power to generate the average input signal power.

1 59. The invention of claim 57, wherein each algebraic equation is a piecewise linear curve.

1 60. The invention of claim 57, wherein:

2 the controller is adapted to apply the measure to four algebraic equations to generate four parameter
3 values; and

4 the controller is adapted to apply the four parameter values to two second-order polynomials to
5 update two pre-distortion parameters in the look-up table.

1 61. The invention of claim 57, wherein the pre-distortion parameters are frequency-dependent pre-
2 distortion parameters.

1 62. The invention of claim 57, wherein the pre-distortion parameters are frequency-independent pre-
2 distortion parameters.

1 63. The invention of claim 57, wherein the controller is adapted to update the look-up table at a
2 specified periodic rate.

1 64. The invention of claim 57, wherein the controller is adapted to update the look-up table based on
2 a detected change in operating conditions of the amplifier.

1 65. The invention of claim 64, wherein the detected change in the amplifier operating conditions
2 corresponds to a change in a parameter value greater than a specified threshold value.

1 66. The invention of claim 57, wherein the controller is adapted to fine-tune the one or more
2 parameter values based on output spectrum of the amplifier.